

WE CLAIM:

1. An injectable liposomal composition for delivery of a water-soluble substance, the composition comprising:
 - a plurality of liposomal vesicles comprising a high weight ratio of a lipid to an encapsulated water-soluble substance so as to achieve a high efficiency of encapsulation.
2. The composition of claim 1, wherein the encapsulation efficiency is more than about 50%.
3. The composition of claim 1, wherein the encapsulation efficiency is more than about 80%.
4. The composition of claim 1, wherein the liposomal vesicles are multilamellar vesicles (MLV).
5. The composition of claim 1, wherein the water-soluble substance comprises more than one compound.
6. The composition of claim 1, wherein the water-soluble substance is selected from the group consisting of a protein, a proteoglycan and a carbohydrate.
7. The composition of claim 1, wherein the water-soluble substance comprises a vaccine.
8. The composition of claim 7, wherein the vaccine is directed against a hormone or a hormone cognate receptor.
9. The composition of claim 7, wherein the vaccine comprises at least one hormone-immunomimic peptide or at least one hormone receptor-immunomimic peptide, and wherein the immunomimic peptide is conjugated to an immunogenic hydrophilic carrier protein.
10. The composition of claim 1, wherein the weight ratio of lipid to encapsulated substance ranges from about 50 to about 1000.
11. The composition of claim 1, wherein the weight ratio of lipid to encapsulated substance is about 300.
12. The composition of claim 9, wherein the immunomimic peptide is a synthetic sequence selected from the group consisting of gastrin G-17, gastrin G-34, GnRH, hCG and fragments thereof.
13. The composition of claim 12, wherein the synthetic sequence is the gastrin G-17 of SEQ NO:1.
14. The composition of claim 13, wherein the synthetic gastrin G-17 fragment sequence is a sequence selected from the group consisting of SEQ ID NOS:3-8.
15. The composition of claim 12, wherein the synthetic sequence is the G-34 peptide of SEQ ID NO:12.
16. The composition of claim 12, wherein the synthetic peptide is the GnRH immunomimic peptide of SEQ ID NO:15.

17. The composition of claim 12, wherein the synthetic peptide is the hCG immunomimic peptide of SEQ ID NO:16.
18. The composition of claim 1, wherein the lipid comprises a hydrophobic chain and a polar or chemically reactive portion.
- 5 19. The composition of claim 1, wherein the lipid comprises a hydrocarbon chain or steroid tail group, and a polar head group.
20. The composition of claim 18, wherein the polar head group or chemically reactive portion comprises an acid, alcohol, aldehyde, amine or ester group.
21. The composition of claim 1, wherein the lipid comprises a phospholipid.
- 10 22. The composition of claim 21, wherein the phospholipid is selected from the group consisting of phosphatidic acid, phosphatidyl choline, phosphatidyl ethanolamine, phosphatidyl glycerol, phosphatidyl inositol, and sphingomyelin.
23. The composition of claim 1, wherein the liposome comprises at least about 70 mole percent dimyristoyl phosphatidylcholine (DMPC).
- 15 24. The composition of claim 7, wherein the encapsulated vaccine has a dose of from about 50 µg to about 5mg.
25. The composition of claim 8, wherein the encapsulated anti-hormone vaccine or anti-hormone receptor vaccine has a dose ranging from about 0.3 mg to about 5 mg.
26. The composition of claim 9, wherein the immunomimic peptide is conjugated to the
20 immunogenic carrier through a spacer peptide.
27. The composition of claim 26, wherein the spacer peptide is selected from the group consisting of SEQ NOS: 9, 10, and 11.
28. The composition according to claim 1, wherein the liposome vesicles encapsulate a water-soluble immunogen and a water-soluble high molecular weight immunomodulatory
25 substance, either together or in separate liposome vesicles.
29. The composition according to claim 1, wherein the liposome vesicles encapsulate a water-soluble immunogen and a water-soluble low molecular weight immunomodulatory substance, either together or in separate liposome vesicles.
30. The composition according to claim 28, wherein the high molecular weight
30 immunomodulatory substance comprises a cytokine.
31. The composition according to claim 30, wherein the low molecular weight substance is selected from the group consisting of nor MDP, threonyl MDP, murabutide, N-acetylglucosaminyl-MDP, and murametide.
32. An aseptic composition comprising an injectable aqueous suspension of the composition of
35 any one of claims 7-17.

33. A pharmaceutical formulation comprising a therapeutically effective amount of the composition of claim 1, and a pharmaceutically acceptable carrier.
34. A method of treatment of a disorder or disease, comprising administering to a patient in need of the treatment a therapeutically effective amount of the pharmaceutical formulation of claim 33.
35. A method for producing a liposomal vaccine comprising the steps of: preparing phospholipid multilamellar vesicles and encapsulating a water-soluble immunogen or an immunomodulating substance, or both, wherein the liposomes have a high lipid:protein ratio.
36. The method of claim 35 wherein the lipid:protein ratio is in the range from about 50 to about 1000.
37. The method of claim 36 wherein the ratio is about 500.
38. The method of claim 37 wherein the ratio is about 300.
39. A liposomal composition of high lipid:protein weight ratio comprising an immunogenic construct of immunogenic carrier conjugated to peptide selected from the group consisting of SEQ ID NOS: 17, 18, 19, and 20.
40. A method for producing a liposomal vaccine containing a high dose of immunogen, the method comprising:
rehydrating a lyophilized lipid complement with water or an aqueous ethanol solution, at which step the immunogen is contained either in the lipid complement or the aqueous ethanol solution.
41. The composition of claim 1, wherein the composition exhibits low injection site reactogenicity in a mammal.
42. The composition of claim 41, wherein the mammal is a rabbit.
43. The composition of claim 42, wherein the injection site reactogenicity is substantially no inflammation or other gross pathological abnormality.
44. The composition of claim 41, wherein the mammal is a human.
45. The composition of claim 44, wherein the injection site reactogenicity is substantially no inflammation or other gross pathological abnormality.
46. The composition of claim 41, wherein the low reactogenicity is exhibited when the composition is delivered intramuscularly.
47. The composition of claim 41, wherein the low reactogenicity is exhibited when the composition is delivered subcutaneously.
48. The composition of claim 41, wherein the low reactogenicity is exhibited when the composition is delivered intradermally.

- 49. A method of treatment according to claim 34, wherein the composition is delivered intramuscularly.
- 50. A method of treatment according to claim 34, wherein the composition is delivered subcutaneously.
- 5 51. A method of treatment according to claim 34, wherein the composition is delivered intradermally.